

National Bureau of Standards

Certificate

Standard Reference Material 1522

Set No.

Silicon Power Device Level Resistivity Standard

This Standard Reference Material is intended primarily for use as a reference standard by both producers and consumers of semiconductor grade silicon when using the four-probe method of measuring semiconductor resistivity (ASTM F-84). However, the thickness of the slices in this SRM has been made compatible for additional use with contactless resistivity measurement equipment.

This SRM consists of three slices of silicon with nominal resistivities of 25, 75, and 180 ohm-centimeters, respectively. Each slice has been individually measured for resistivity at the National Bureau of Standards. The measurements for the slices in the set designated above are as follows:

	(25 $\Omega\cdot\text{cm}$)	(75 $\Omega\cdot\text{cm}$)	(180 $\Omega\cdot\text{cm}$)
Slice Number	N25-	N75-	N180-
Thickness	mm	mm	mm
Diameter	mm	mm	mm
Measuring Current (nominal)	A	A	A
Voltage-current ratio ¹			
Resistivity ²	$\Omega\cdot\text{cm}$	$\Omega\cdot\text{cm}$	$\Omega\cdot\text{cm}$

¹Measurement average-uncorrected.

²Corrected for geometry and for temperature to 23 °C.

The silicon crystals used for these standards are (111) orientation and were phosphorous doped by neutron transmutation of float zone starting crystals. Resistivity measurements were carried out in accordance with ASTM Method F-84 with the exception that measurement current was chosen to maintain measured specimen voltage between 10 and 12 mV. Correction factors applied to the data are those of ASTM Method F-84, a copy of which will be provided to those who purchase sets of slices.

Washington, D.C. 20234
April 26, 1979

George A. Uriano, Chief
Office of Standard Reference Materials

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Additional Information:

All measurements used for certification were performed by one operator using one set of instrumentation. [However, additional measurements were made to estimate the precision of the certified values. These measurements were made on five specimens at each resistivity level included in this SRM by each of two operators on each of two instruments (four instrument-operator combinations). This includes the operator-instrument combination used for certification.] The resulting approximate 95% confidence intervals for certification are 0.2, 0.4 and 0.6% of the measurement averages reported on the face of this certificate for the nominal 25, 75, and 180 ohm·cm specimens, respectively. In routine laboratory use, however, the 95% confidence intervals obtained from multi-laboratory experiments may be more realistic. Such experiments were conducted to test the reproducibility of average resistivity measurements when using ASTM Method F-84. The results of these experiments indicate that the 95% confidence intervals are: $\pm 1.3\%$ of the average value for specimens with resistivities up to 120 ohm·cm, and $\pm 3.6\%$ of the average value for specimens with resistivities between 120 and 500 ohm·cm.

The physical preparation and resistivity testing of these specimens was performed by L. Robinson and D. Ricks. Technical measurement coordination and overall direction of the technical activities were performed by J. R. Ehrstein of the Electron Devices Division.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by W. P. Reed.